

LIMBER PINE AND BEARS

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Limber pine (*Pinus flexilis*) is not considered a fall food for black bears (*Ursus americanus*) or grizzly bears (*Ursus arctos*) in the Rocky Mountain region of the United States. Previous studies have found that other nut-bearing plant species such as whitebark pine (*P. albicaulis*) and Gambel oak (*Quercus gambelii*) are preferred over limber pine by bears (Kendall 1983, Mace and Jonkel 1986, Beck 1991). However, these studies have been conducted only in areas where limber pine is in sympatry with other hard-mast species.

During a study of black bears from 1984 to 1992 (McCutchen 1993) in Rocky Mountain National Park, it became apparent that bears utilized limber pine some years. This paper reports on that use of limber pine and discusses the implications.

Rocky Mountain National Park, encompassing 107,000 ha, contains elevations among the highest in the continental U.S., ranging from 2440 m to 4345 m. Nearly 1/3 of the area is alpine tundra above a 3200-m timberline. Below timberline, on the upper slopes, is a subalpine zone of Englemann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*). Extensive stands of lodgepole pine (*Pinus contorta*) and scattered stands of limber pine intermixed with other species are on middle slopes. At lower elevations Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) are common. Limber pine is not found west of the Continental Divide in the park, and the species makes up only about 1% of the forest cover (Hess 1991).

Between 1984 and 1991 I captured 40 individual black bears in and adjacent to Rocky Mountain National Park with culvert traps, with Aldrich foot snares, or at denning sites. Twenty-six bears were radiocollared (Telonics, Mesa, Arizona). Between 1984 and 1991, 9 sub-adult and adult bears (4 females, 5 males) were

captured and radiocollared on the east side of the park. Radiolocations were primarily collected by triangulation from automobile or by hiking. I occasionally used snow tracking to determine bear activities. I used a vegetation type map (Hess 1991) to determine the proportion of radiolocations in stands containing limber pine. Bear scats were collected and analyzed at the Composition Analysis Laboratory, Fort Collins, Colorado, on a gross and microhistological scale (Sparks and Malacheck 1968).

Two female bears (2 and 3) were monitored intensively in 1985 and 1986 (McCutchen 1989). Bear 3, a 3-year-old, was captured on 6 August 1985. In 1985 bear 3 spent a significant amount of time in limber pine stands in fall. During the summer, from 6 August to 3 September, she stayed below 3047 m. We located her 11 times, and none of these locations were in limber pine. In fall, after annual plant senescence began to occur, she made a migration to near timberline and stayed above 3047 m for the next month. From 3 September to 15 October we located her 14 times; 12 of these locations were in stands containing limber pine. On 23 September and again on 11 October I tracked her in the snow and discovered that she had been feeding on nuts of limber pine cones cached in red squirrel (*Tamiasciurus hudsonicus*) middens. At each feeding site the area was littered with cone cores and scales, indicating that she spent considerable time removing nuts from cones. At 2 bed sites, 4 scats were found that consisted almost entirely of limber pine nut shells. She was radiolocated in stands containing limber pine until 15 October, when she moved and denned on 17 October.

The amount of time spent feeding in limber pine stands was high when calculated in relation to the amount of time I estimate she was

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TABLE 1. Radiofixes of black bears in and out of limber pine stands in Rocky Mountain National Park, 1985-1990.

Year	1985			1986			1987			1988			1989			1990		
	Out	In	%	Out	In	%	Out	In	%	Out	In	%	Out	In	%	Out	In	%
2	30	1	3	39	0	0	11	0	0	8	1	11	10	2	17	11	1	8
3	13	12	48	47	0	0	5	1	17	—	—	—	15	3	17	12	1	8
12	—	—	—	—	—	—	8	1	11	8	0	0	17	3	15	10	2	17
TOTAL	43	13		86	0		24	2		16	1		42	8		33	4	

out of the den during the year. Her emergence date from the den in 1985 was unknown because she had not yet been captured. However, she emerged from the den in 1986 on 9 May. Assuming she emerged in 1985 about the same time (9 May) and denmed on 17 October, she was out for about 160 d. During 1985 she fed in limber pine areas from 16 September to 15 October, a period of 30 d, or 19% of her active time during the year.

Bear 2 did not utilize limber pine to the same extent as bear 3 in 1985. Although home ranges of both were adjacent (McCutchen 1989), bear 2 was located in a limber pine area only once out of 30 radiolocations. Bears 2 and 3 were again intensively radiomonitored in 1986 but were not observed to use limber pine (Table 1).

Another observation of bear use of limber pine habitat was made in 1991. A radiocollared 3-year-old male moved into bear 3's home range during emigration from his natal range about 20 km to the south. On 6 December he was tracked in the snow and was found to have dug up squirrel caches of limber pine cones and nuts. He was radiolocated in limber pine areas until 17 December.

Further analysis of radiolocations from bears on the east side of the park indicated that 4 of 9 (bears 2, 3, 12, 24) had been located in limber pine habitat at least once, 3 of these several times (Table 1). Percentage of time individual bears were found in limber pine stands varied from 0% to 48%. Of 272 total radiolocations, bears were found in forest types containing limber pine 28 times, or 10.3%.

The importance of limber pine for bears in the park during the 1985 radiotracking operation was reinforced by 14 scat samples collected during that year. Four of these (29%) consisted almost entirely of limber pine seeds.

A review of the literature on bear research north and south of the park in the Rocky Mountain region suggests that limber pine is

not important if other hard-mast species are present. Black and grizzly bears fed on whitebark pine but not limber pine in Yellowstone National Park (Kendall 1983) and in northern Montana (Mace and Jonkel 1986). Aune and Kasworm (1989) found essentially no grizzly use of limber pine in 10 yr of study in the Montana Front Range. In Montana, Idaho, and most of Wyoming, whitebark pine is either the sole hard-mast species or is more common than limber pine. In south central Colorado, Beck (1991) found that black bears made long-distance movements to feed on acorns of Gambel oak but not on limber pine. However, there are areas in Colorado and Wyoming where limber pine is the sole hard-mast-producing species present and may be important to bears (Fig. 1).

Bear preference for whitebark pine and Gambel oak over limber pine is probably related to several factors. Limber pine seeds are smaller than the other two, producing 10.8×10^3 seeds/kg as compared to whitebark pine at 5.7×10^3 seeds/kg (McCaughey and Schmidt 1990) and Gambel oak at 1.3×10^3 /kg (Harper et al. 1985). Limber pine generally produces large seed crops at wide and irregular intervals with small amounts produced nearly every season. Whitebark pine seeds are produced at frequent and regular intervals (Harlow et al. 1979) with good crops produced at intervals of 3-5 yr (McCaughey and Schmidt 1990). In south central Colorado, Beck (1991) found Gambel oak production to be quite regular with only 1 massive acorn crop failure in 10 yr.

From the limited number of observations of limber pine use by bears in Rocky Mountain National Park, I suggest that if limber pine is the only hard mast available during certain years, perhaps years of limited production of other foods, it may be an important food source for the survival of bears. This hypothesis needs to be tested by further research.



Fig. 1. Distribution map of limber pine in the Rocky Mountain region in relation to other hard-mast bear foods based on Little (1971). Limber pine only (shaded fill) designates areas where limber pine occurs exclusive of any other hard-mast species. In this area limber pine may be important to bears as a food source. Other species preferred (dotted fill) designates areas of limber pine distribution where other hard-mast species, whitebark pine to the north and Gambel oak to the south, dominate and are preferred by bears over limber pine. (Note: State and county boundaries are shown to locate limber pine range; GNP = Glacier National Park, YNP = Yellowstone National Park, RMP = Rocky Mountain National Park, MP = Monarch Pass.)

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